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**A LEAKPROOF, RESEALABLE CONTAINER AND CAP ASSEMBLY**

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## **BACKGROUND OF THE INVENTION:**

It is desirable to provide a container that can be opened, sealed, or resealed using a frontal, singular motion and that can still produce a leakproof seal. For example, during laboratory applications such as drug testing, users of the containers desire the accessibility and resealability of the specimen by simply using frontal thumb pressure upon the thumb tab of the container to result in a leakproof container. In addition to ease to use, the integrity of the specimens in the containers is significant in ensuring proper chain of custody requirements of the container contents.

## **SUMMARY OF THE INVENTION:**

The present invention relates to a leakproof and resealable container and cap assembly. In one embodiment of the present invention, the assembly comprises a cap and container attached by a hinge. The container has an upper portion and an outer surface, and at the upper portion, the container has a rim. The cap has a circular base with an outer periphery and a cylindrical tubular skirt extending perpendicularly and outwardly around said outer periphery of the base; the skirt has an inner wall which includes at least one recess. In another embodiment, the cap has opposing ends; the cap has a thumb tab for facilitating the opening and closing of the container and the hinge attached to the container. The thumb tab and hinge are positioned on opposing ends of the cap and extend perpendicularly and outwardly from the skirt of the cap. In a further embodiment, the skirt of the cap overlies the container and the rim of the container is situated within the recess of the inner wall of the skirt of the cap during a closed position.

In yet another embodiment, the container further comprises a flange (i.e. an anti-decapping ring that serves to prevent the cap from being unintentionally opened and also serves as a visual scale to assure uniform cap position around the flange) projecting radially outwardly from the outer surface of the container. In still another embodiment, the hinge is attached to the container flange and the skirt of the cap is designed to overlie the rim of the container and be in uniform close proximity to the container flange during the closed position.

In a further embodiment, the cap and container assembly, in a closed position, forms an air tight seal.

In another embodiment, the cap and container are molded of plastic. In yet another embodiment, the cap and container are integrally molded of the plastic to form a hinge therebetween. In still another embodiment, the cap is fit to the container during the closed position to form a leakproof, air tight seal.

In a further embodiment, the hinge of the assembly has a recess. The recess forms two elements, the first element being attached to the skirt of the cap and the second element being

attached to the container. In still a further embodiment, the recess functions as a bending point during the opening and closing of the container.

The present invention also relates to a method of manufacturing a leakproof resealable container and cap assembly, comprising: providing a container and cap connected by a hinge, the container has an upper portion and an outer surface, the container includes a rim at the upper portion; the cap has a circular base with an outer periphery and a cylindrical tubular skirt extending perpendicularly and outwardly around the outer periphery of the base, the skirt has an inner wall having at least one recess; the cap has opposing ends, the cap including a thumb tab; the tab and hinge is positioned on opposing ends of the cap and extend perpendicularly and outwardly from the skirt of the cap; and closing the container by applying, in a singular motion, a frontal, downward pressure upon the thumb tab to allow the skirt to overlies the container and the rim of the container to be situated within the recess of the inner wall of the skirt of the cap.

#### **BRIEF DESCRIPTION OF THE DRAWINGS:**

A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily understood by reference to the following description when considered in connection with the accompanying drawings in which:

FIGURE 1 is a longitudinal sectional view of one embodiment through the leakproof, resealable container and cap assembly in accordance with the present invention;

FIGURE 2 is an overhead plan view of one embodiment of the container and the cap connected by the hinge in an opened position;

FIGURE 3 is a side elevation view of one embodiment of the container and cap assembly of the present invention in a closed position;

FIGURE 4 is a cross-sectional side view of one embodiment of the assembly in a closed position; and

FIGURE 5 is a detailed blow-up showing a portion of the cap and container of one embodiment of the container and cap assembly of the present invention with measurements and angles.

Among those benefits and improvements that have been disclosed, other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings. The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

### **DETAILED DESCRIPTION OF THE PRESENT INVENTION:**

The present invention relates to a leakproof and resealable container and cap assembly. The term "resealable" means that the container can be opened/reopened and closed/reclosed a numerous amount of times. The term "leakproof" means that the container passes the blue crystal dye test. The blue crystal dye test is a visual test to detect leaks within a container seal. A container "passes" the blue crystal dye test if the white paper, in which the container is placed on, does not visually change color (i.e. The white paper does not become contaminated with the blue crystal dye liquid from the container). The blue crystal dye test procedure consists of the following : (a) the blue crystal dye liquid is prepared by adding one teaspoon of blue crystal dye powder to one gallon of alcohol and the thoroughly mixing the solution; (b) the blue crystal dye liquid is poured into the container (i.e. a sufficient amount of the dye liquid must be added so, when the container is placed upside down, the entire seal area must be covered); (c) the container is closed by applying, in a singular motion, a frontal downward pressure upon the thumb tab (e.g. a user places his/her thumb parallel or on top of the thumb tab and applies a singular downward pressure) until the rim portion, adjacent to the thumb tab, contacts the inside flat part of the cap; (d) the container is placed upside down (i.e. inverted) on the white paper at room temperature; and (e) after 30 minutes, the white paper is inspected to determine if the white paper is contaminated with the blue crystal dye liquid.

In another embodiment, the cap and container assembly, in a closed position, forms an air tight seal. The term "air tight" means the moisture ingress of the container (after three days) was less than about 750 micrograms of water, preferably, about 250 micrograms of water, more preferably, about 150 micrograms of water determined by the following test method: (a) place one gram plus or minus 0.25 grams of molecular sieve in the container and record the weight; (b) the container is closed by applying, in a singular motion, a frontal downward pressure upon the thumb tab until the rim portion, adjacent to the thumb tab, contacts the inside flat part of the cap also adjacent to the thumb tab; (c) place the closed container in an environmental chamber at conditions of 80% relative humidity and 72°F; (c) after one day, weigh the container containing the molecular sieve; (d) after four days, weigh the container containing the molecular sieve; and (e) subtract the first day sample from the fourth day sample to calculate the moisture ingress of the container in units of micrograms of water.

Referring now to the drawings wherein like reference numerals designate identical or corresponding parts throughout the several views, and more particularly to FIG. 1 wherein one embodiment of the leakproof, resealable cap and container assembly 10 of the present invention is

illustrated. The assembly 10 consist essentially of a container 20 having a base 28, an internal cavity 27, an outer surface 25, an upper 21 and lower 26 portion. The container 20 has a rim 22 at the upper portion 21. The assembly 10 also has a cap 30 which has a circular base 31 and a cylindrical tubular skirt 33 extending perpendicularly and outwardly around the outer periphery of the base 31. The cap 30 has opposing ends, at one end the cap 30 has a thumb tab 36 for facilitating the opening and closing of the container, and a hinge 40 attached to the container 20. The tab 36 and hinge 40 are positioned on opposing ends of the cap and extend perpendicularly and outwardly from the skirt 33 of the cap 30.

The container may also have a flange 24 projecting radially outwardly from the outer surface 25 of the container 20. The hinge 40 may also be attached to the container flange 24. The hinge 40 also has a recess 42 that functions as a bending point during the opening and closing of the container.

Suitable material for assembly 10 includes plastic (e.g. thermoplastics such as polypropylene and polyethylene). In one embodiment, the cap 30 and container 20 may be integrally molded of the plastic to form a hinge 40 therebetween. In one embodiment, the cap 30 and container 20 may be produced in a molding process and, in another embodiment, may be molded in accordance with the mold similar to that disclosed in U.S. Patent Nos. 4,783,056 and 4,812,116, respectively. In a further embodiment, with such a process and mold, the assembly, including the cap, container and hinge may be produced in accordance with the operation disclosed in U.S. Patent Nos. 4,783,056 and 4,812,116 or, in another embodiment, may be produced in accordance with U.S. Patent No. 5,723,085. The disclosure of these patents are incorporated by reference herein.

In another embodiment, two step (i.e. thickened sections of the hinge) bridge the recess 42 on opposing ends of the recess. In yet a further embodiment, the first element of the hinge 40 is from about 0.03 inches to about 0.125 inches, preferably 0.06 inches, measured from the center-line of the recess and the outside perimeter of the cap. In still yet another embodiment, the second element of the hinge 40 is from about 0.1 inches to about 0.195 inches, preferably 0.125 inches, measured from the center-line of the recess to the outside perimeter of container.

In another embodiment, the thumb tab 36 (which is located in the frontal portion of the cap) is from about 0.125 inches to about 0.325 inches, preferably 0.235 inches, measured from the outside perimeter of the cap to the end of the tab. In still another embodiment, the assembly 10 can be sealed and/or resealed by applying, in a singular motion, a frontal, downward pressure upon the thumb tab to obtain a leakproof seal. As an example, a user places his/her thumb parallel

or on top of the thumb tab (i.e. the frontal portion of the container) and applies a singular downward pressure until an audible snap is heard and then verified by visual inspection of uniform cap position around the flange.

FIG. 2 refers to an overhead plan view of the assembly 10 to the present invention in an opened position. The assembly 10 includes the container 20 and the cap 30 connected by the hinge 40. The container 20 has the cavity 27, the rim 22, and the flange 24. The cap includes the circular base 31, the inner wall 35 with the recess 32, and the thumb tab 36. The hinge 40 has two elements, 41 and 43, respectively, formed by the recess. One element 41 is attached to the flange 24 of the container 20 and the second element 43 is attached to the cap 30.

FIG. 3 depicts a side elevation view of the present invention in a closed position. The cap and container assembly 10 comprises the cap 30 and the container 20 connected by the hinge 40. The container 20 has a flange 24 extending from the outer surface 25 and a base 28. The cap 30 has a cylindrical skirt 33 and the thumb tab 36 extending perpendicularly outwardly from the skirt 33. In a closed position, the skirt 33 of the cap 30 overlies the container 20 and lies upon the flange 24 of the container 20.

FIG. 4 illustrates a cross-section view of the assembly 10 in a closed position. The skirt 33 of the cap 30 overlies the container 20 and lies upon the flange 24 of the container 30 while the rim 22 of the container 20 is situated within the recess 32 of the inner wall 35 of the skirt 33 of the cap 30. The container 20 can be sealed and/or resealed by applying, in a singular motion, frontal, downward pressure upon the thumb tab 36 to obtain a leak proof seal and/or an air tight seal.

FIG. 5 illustrates a cross-section view of one embodiment of the cap and container assembly of the present invention made of polypropylene with measurements and angles detailed in Figure 5. In this embodiment, the rim 22 has one engagement surface, which has about a 20 degree vertical inclination for locking engagement against the corresponding surface of the cap. The rim 22 also has a rounded edge, which has about a 5 degree vertical inclination, for ease of closing. The inner wall of the skirt 33 of the cap 30 has a recess 32 having a first angular plane surface of about 5 degrees from the reference vertical, a second angular plane surface of about 21 degrees from a reference vertical, and a third angular plane surface of about 31 degrees from a reference vertical. In another embodiment, the recess 32 has two angular plane surfaces - - (i.e. the 5 degree angular plane surface of Figure 5 is eliminated).

Numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the attendant claims attached hereto, this invention may be practiced otherwise than are specifically disclosed herein.